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NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

OF THE

COLLEGE OF AGRICULTURE AND
MECHANIC ARTS

WEST RALEIGH

SELF-STERILITY OF THE SCUPPERNONG AND OTHER MUSCADINE GRAPES

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THE NORTH CAROLINA

AGRICULTURAL EXPERIMENT STATION

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Address all communications to

N. C. AGRICULTURAL EXPERIMENT STATION,
WEST RALEIGH, N. C.

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SELF-STERILITY OF THE SCUPPERNONG AND OTHER MUSCADINE GRAPES

BY

F. C. REIMER and L. R. DETJEN.

The subject of self-sterility is one of the most important connected with fruit culture. Horticulturists know that certain varieties will produce very little or no fruit when isolated or planted by themselves. It has been conclusively demonstrated that some varieties of plums, pears, apples, grapes, and figs must be planted near other varieties to make them fruitful. For example, the Wildgoose plum when planted by itself will produce very little fruit. While many orchards in the South solely of this variety are producing fruit, it is because every thicket or roadside contains many trees of the wild Chickasaw plum, which supply an abundance of pollen that is carried to the flowers of the Wildgoose plum by bees. The amount of fruit in such orchards decreases as the distance from these wild Chickasaw plums increases. The Kieffer pear, which is one of the most prolific of all varieties when planted in a mixed orchard, often bears very little fruit when planted by itself. There are many fig trees in this State which drop all of their fruit regularly because their flowers are not properly fertilized with pollen from other types of figs.

It can be understood that this is a question of great practical importance, and that one should know definitely before planting a certain variety whether it is self-fertile or self-sterile. Unfortunately, this question has not been answered for many of our fruits; the subject, therefore, offers a splendid field for investigation.

SELF-STERILITY OF MUSCADINE GRAPES

During the last few years great interest has been manifested in the Muscadine grapes—*Vitis rotundifolia*. In many instances large vineyards, sometimes exceeding a hundred acres in area, have been planted. One of the most important questions that has been asked by the leading growers is that relating to self-sterility. The Horticulturist of the Station has often been asked this question, and has had considerable correspondence regarding the matter. Letters have come not only from this State, but from other Southeastern States, and as far west as Texas.

If the variety is self-sterile it will be necessary for best results to plant and maintain in the vineyard male vines which do not bear any fruit. If the variety is self-fertile it would not be necessary to go to this expense. The question ought to be definitely and finally answered by experimental results.

The discussion of this question has become important because it has been variously answered by different people. This Station in

two of its Bulletins has stated that the Scuppernong grape is self-sterile. A Bulletin from the South Carolina Station states that it is self-fertile. One of the largest nurserymen in the South maintains that the variety is self-sterile; and another leading nurseryman states that it is self-fertile. The growers and planters do not know whose advice to follow, as no conclusive evidence has been given. In April, 1909, this Station published Bulletin No. 201, which gave for the first time the results of experimental work on the problem of self-sterility in Muscadine grapes.

Our work on this problem has now been carried on for three years and we believe that the results are conclusive. These results should be of great value to grape growers.

INVESTIGATIONAL WORK.

A careful study has been made of self-sterility of Muscadine grapes by (1) bagging the flower clusters; (2) germination tests of pollen; (3) microscopic study of pollen; (4) proportion of flowers that develop fruit; (5) study of the structure of flowers; and (6) influence of male vines on crop.

TYPICAL VINES TESTED.

Representative vines of each variety were selected for this work. Some of the vines are noted for their heavy bearing quality; others

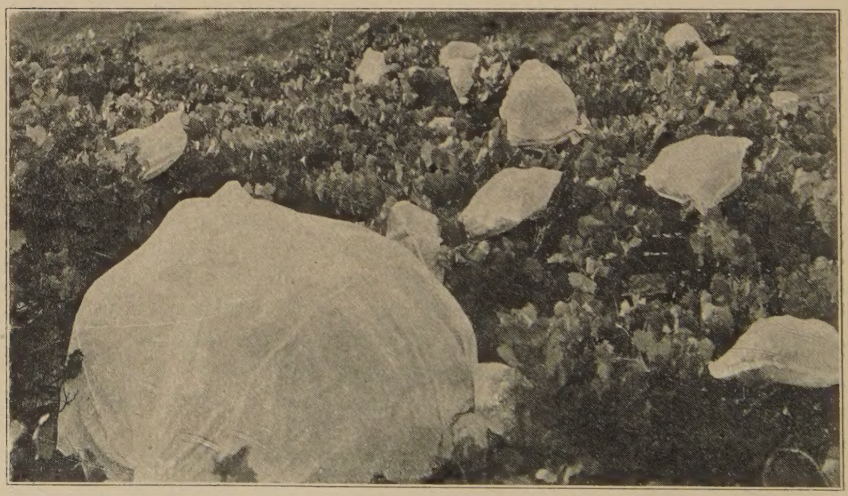

FIG. 1.—Vine showing covered branches and flower clusters.

are simply good average vines, typical of the variety. Only two very poor yielders were selected, of which special mention will be made. To make the results as conclusive as possible, the work was conducted

in both the Lower Piedmont and Coastal Plain section of the State. All but one of the important varieties of this species originated in the Coastal Plain section of North Carolina. The work with two of the varieties was conducted in the vineyard in which they had originated; and in one case on the original vine itself. The Scuppernong vines were located on thirteen different farms; while the fruiting forms of the wild Muscadines were at eighteen different places.

BAGGING.

If a variety is self-fertile, its own pollen will fertilize the ovaries and it will develop fruit even though the flowers are covered during the blooming season so as to exclude foreign pollen. If the variety is self-sterile, it will require pollen from another plant to fertilize its flowers to bring the fruit to maturity. Covering the flowers of such a self-sterile plant during the blooming season would prevent the entrance of other pollen and prevent any fruit from setting.

FIG. 2.—Two branches rom Scuppernong vine shown in Fig. 1, photographed immediately after removal of bags. Cluster on left treated with male pollen, cluster on right untreated.

In the preliminary work, light paper bags, mosquito netting, and Pacific lawn were used for covering, and it was found that the latter is the most satisfactory material. It is light in weight, allows air and

light to pass through readily, has very fine meshes, and is very durable. One hundred and thirty yards of this was made into bags varying in size from 4 x 6 inches to 3½ x 4½ feet.

The bags were put on just before the first flowers opened and left on until after the blooming season. Fig. 1 shows some of these bags on the vine. The number of flower clusters in each bag varied from one in the smallest bags to about four hundred in the largest. The flower clusters of the Muscadine are small and are borne mostly on short branches. The main branches are very much divided so that a bag 12 x 16 inches will often cover from forty to fifty flower clusters.

BAGGING THE SCUPPERNONG.

In 1908, twenty-five branches on two vines were covered. Twenty of these were left untreated, and no fruit developed on them. In the other five bags male flower clusters were tied to the Scuppernong flower clusters as soon as the flowers had opened; in three of these bags normal clusters of fruit developed.

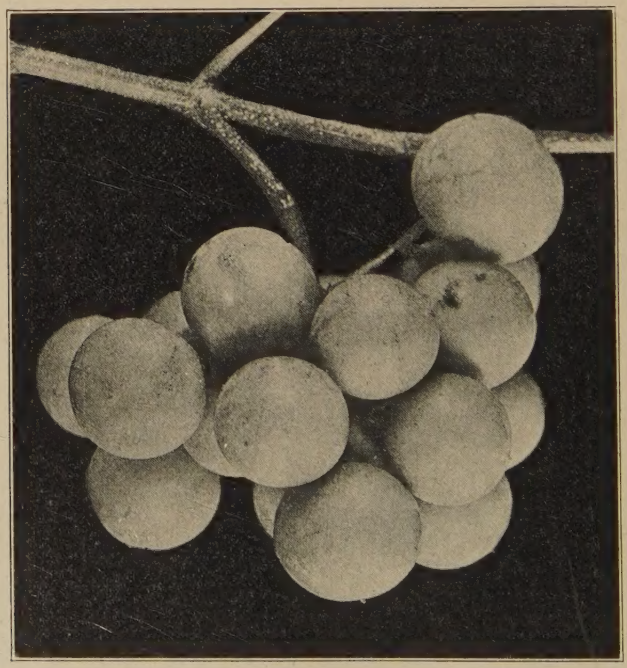

FIG. 3.—Large Scuppernong fruit-cluster, the result of hand pollination with male pollen.

In 1909, one hundred and five branches on three vines were covered. Fifty of these were left untreated; no fruit developed in these bags. In the other fifty-five bags male flower clusters were inserted.

In eleven of these normal fruit clusters developed. The small proportion of bags containing fruit where male flowers were inserted was probably due to the fact that the male flowers had not opened when inserted, and many of them dried up before opening.

The most extensive work was done during the blooming season of the present year, 1910, when two hundred and sixty-four branches on six vines were covered. Two hundred and eight of these were left untreated, and one hundred and ninety-eight did not develop a single berry. The other ten untreated branches, which were all on one vine, gave some interesting results. Each of these ten bags contained from one to twenty-seven poorly developed, flat, seedless berries, from one-tenth to one-fifth normal size. Only two of these contained more than ten berries; the average of the ten bags being 6.8 berries to the bag. Two of these ten bags also contained one normal berry each

FIG. 4.—Branch of Scuppernong, showing crop in one bag where flowers had been hand-pollinated with male pollen.

with seed, and one bag had two small berries containing small, hollow worthless seeds. Three of the bags used on this vine were very large, each bag containing about four hundred flower clusters. The total

number of flower clusters in these ten bags was about fourteen hundred. This gives an average of one small seedless berry to every twenty flower clusters, and one berry with seed for every seven hundred flower clusters on this vine. The seedless berries developed without any fertilization. The two berries containing normal seeds were properly fertilized, but we do not know how the male pollen got into these bags. It is possible that it was washed through the meshes of the sacks by rain.

The other fifty-six covered branches on these six vines were carefully hand-pollinated several times with pollen from a male vine. Fifty-three of these branches developed normal fruit. Most of these branches were heavily loaded, some of them containing at least ten times as much fruit as similar branches on the same vines which had not been covered, and were exposed to chance cross-pollination. The clusters in many of the bags were much larger than those usually produced by this variety; several clusters contained over twenty berries each. One small bag with several clusters contained one hundred and twenty-two large, normal berries.

On one of the most prolific Scuppernong vines under experiment four branches of practically the same size and all on the same arm were selected. These were not covered and hence were exposed to the visits of insects. Two of the branches were left untreated; these developed twenty-two berries. The other two were hand-pollinated several times with pollen from a male vine. One of these developed ninety and the other one hundred and seventy-one berries (Fig. 5). This difference was more marked than it would be in a more favorable blooming season.

One of the Scuppernong vines and two of the James vines worked with during 1910 were the most prolific vines that the writers have ever seen, but these proved to be self-sterile like all the others.

One of the Scuppernong vines used in the work in 1910 was eight years old but had never borne any fruit. Eight flower clusters were selected on this vine, six of which were covered with bags. Four of these covered clusters were left untreated; no fruit developed in these bags. But male pollen was applied to the flowers in the other two bags, and to the two flower clusters which were left uncovered; every one of these developed a good cluster of fruit.

As the stamens are short and reflexed in the flowers of the Scuppernong, it might be supposed that no fruit could set on the covered clusters as all insects were excluded and it would be impossible for the pollen to get on the stigma, even though the variety might be self-fertile. In 1909, twenty-seven flower clusters of the Scuppernong were bagged, and later, when the flowers had opened, pollen from the James grape was applied to the stigmas; not a single berry set. In 1910, fourteen branches of the Scuppernong containing many flower clusters were similarly covered. Nine of these were carefully hand

pollinated with pollen from another portion of the Scuppernong vine, and five with pollen from a James vine. One small seedless berry developed in one bag where the James pollen was applied, and a similar berry where the Scuppernong pollen had been applied. This

FIG. 5.—Branch of Scuppernong, flowers on right hand pollinated with male pollen, on left untreated. This branch was not covered. 1910, an unfavorable blooming season.

proves that the pollen from the Scuppernong is ineffective on its pistils. Also that the pollen from the James, typical of other Muscadine varieties now in cultivation, is ineffective on the Scuppernong.

WORK WITH OTHER VARIETIES.

FLOWERS.

During 1908, twenty-five branches on two vines were covered to prevent cross-pollination; no fruit set in any of these bags.

In 1909, seventy-eight branches on two vines were covered; no fruit developed.

In 1910, twenty branches were covered on one vine. Fourteen of these were left untreated, and no fruit set in these bags. The other six bags were opened several times and male pollen applied to the pistils; five of those bags contained well developed clusters of fruit.

JAMES.

In 1908, twenty-six branches were covered on one vine. All of these were left untreated, and no fruit set.

In 1910, eighty-three branches on six vines were covered. Sixty-seven of these were left untreated, and no fruit set. Sixteen were carefully hand-pollinated with male pollen; fourteen of these bags contained good clusters of fruit.

THOMAS.

In 1909, thirty-eight bags were placed on one vine; no male pollen was added and no fruit developed.

In 1910, twenty-six bags were put on one vine. Twenty of these were left untreated, and no fruit set. The other six branches were carefully hand-pollinated with male pollen; five of these bags developed normal clusters of fruit.

MISH.

In 1909, twenty-five bags were put on one vine. No male pollen was added and no fruit set.

Summarizing these results for the Scuppernong, Flowers, James, Thomas, and Mish, we have five hundred and sixty-eight branches, each containing from one to four hundred flower clusters, which were covered to exclude the foreign pollen. In five hundred and fifty-eight of these bags no fruit developed. In eight bags, small, seedless, practically worthless, berries developed. In two bags, a total of two normal berries, and several small worthless, seedless berries developed.

On the Scuppernong, Flowers, James, and Thomas, one hundred and forty-four branches were covered with bags, and later treated with pollen from male vines. Ninety-one of these bags contained well developed fruit, many of these branches being heavily loaded.

GERMINATION TESTS OF POLLEN.

The germinating power and value of grape pollen can be tested in the laboratory. This is done by placing the pollen in cells containing hanging drops of the proper solution. Various solutions are used for testing purposes, but a solution of cane sugar has proved satisfactory with most pollen grains.

In preliminary work, Scuppernong and male pollen were studied in various strengths of cane sugar solution, varying from nothing to forty per cent concentration. It was found that a thirty per cent solution gave by far the best results with the male pollen. The Scup-

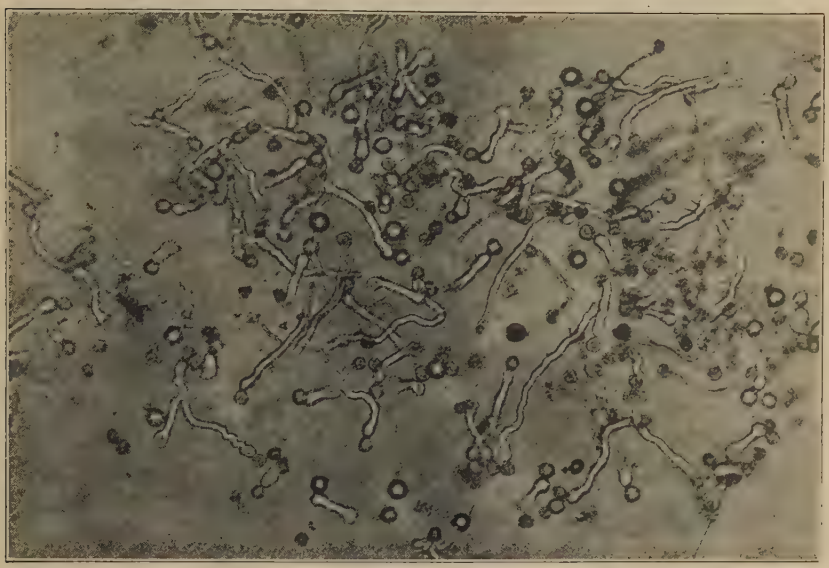

FIG. 6.—Male pollen germinating in sugar solution, after forty-eight hours. (Microphotograph).

pernong pollen did not germinate in any of these strengths. Pure olive oil was also tried, but neither the male nor the Scuppernong pollen germinated in this.

After the preliminary tests were made to determine the best strength of solution, extensive tests were made, the results of which are given in the following table:

Variety.	Number of Cells.	Number of Vines Represented.	Germination Per cent.
Scuppernong	435	14	No germination.
James	30	1	No germination.
Flowers	30	1	No germination.
Thomas	25	1	No germination.
Mish	20	2	No germination.
Memory	25	1	No germination.
Flowers Improved	25	1	No germination.
Hopkins	10	1	No germination.
Tenderpulp	10	1	No germination.
Luola	25	1	No germination.
Labama	10	1	No germination.
San Jacinto	10	1	No germination.
San Melaska	10	1	No germination.
Wild Fruiting Muscadines	486	18	No germination.
Male vines	657	5	2–98.

Each cell contained from two hundred to four hundred pollen grains.

The male pollen germinated vigorously in from three to four hours.

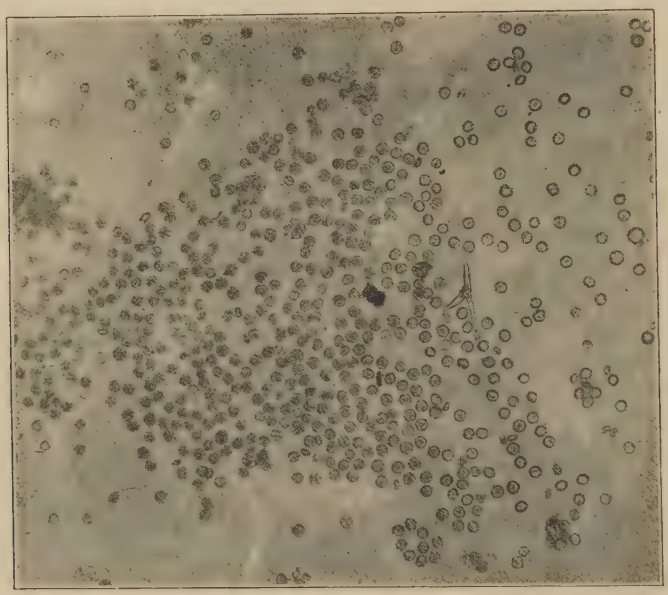

FIG. 7.—Scuppernong pollen in sugar solution after forty-eight hours, showing no germination. (Microphotograph).

Not a single pollen grain from any of the cultivated varieties, or fruiting wild Muscadines worked with in this test, germinated.

MICROSCOPIC STUDY OF POLLEN.

A microscopic examination of the dry pollen of these varieties shows why they are self-sterile. The male pollen grains as shown in Fig. 8 are oblong in shape and plump in appearance. Those of the Scuppernong are very irregular and vary a great deal in shape. They appear like mere shells (Fig. 9). The following varieties were examined and all have worthless pollen like that of the Scuppernong: James, Thomas, Mish, Flowers, Memory, Hopkins, Tenderpulp, Flowers Improved, Luola, Labama, San Jacinto, and San Melaska, and a large number of fruit-bearing wild Muscadines.

STRUCTURE OF THE FLOWERS.

The stamens of the male vines are very long, stand upright, and contain a large amount of pollen. The stamens of the Scuppernong are short, recurved or reflexed, and the anthers contain much less pollen than those on the male vines. The flowers on both types are fragrant.

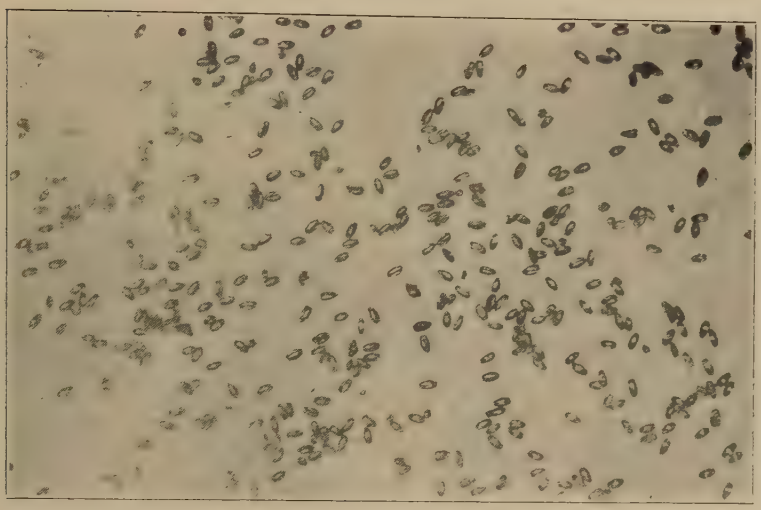

FIG. 8.—Dry male pollen (Microphotograph).

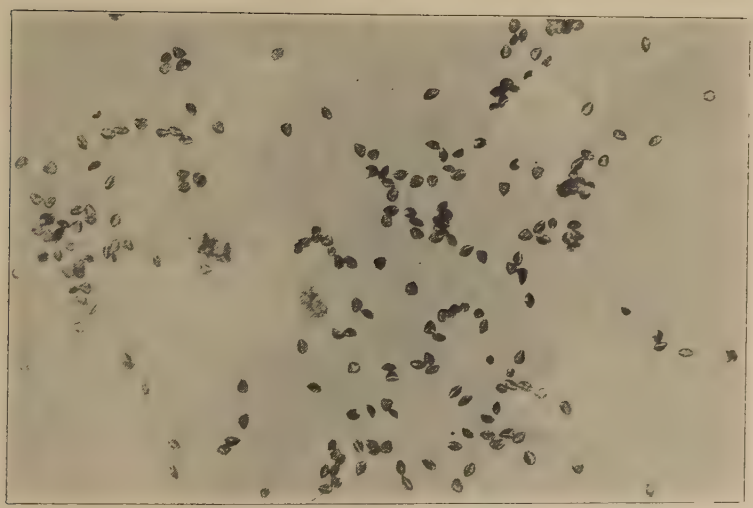

FIG. 9.—Dry Scuppernong pollen (Microphotograph).

The stamens of all the varieties of *Vitis rotundifolia* examined and all except one of the fruiting forms of wild Muscadines are similar to those of the Scuppernong.

Fig. 10.—Flowers of Scuppernong on left, wild Muscadine in middle, and male on right.

NUMBER OF PISTILS THAT DEVELOP INTO FRUIT.

Only a very small proportion of the flowers of the cultivated varieties of this species develop into berries. This accounts for the small clusters. A careful count was taken of all the flowers on a branch. It contained one hundred and twenty flower clusters. The number of flowers in the cluster varied from ten to fifty. The average for the one hundred and twenty clusters was twenty-three flowers to the cluster. The number of clusters that developed berries on this branch was twenty-five. The number of berries to the cluster varied from one to nine, or an average of 2.7. If all the flowers of the Scuppernong developed into fruit, this variety would produce clusters of good size, instead of the small ones which usually contain from one to five berries. As many as sixty flowers have been observed in a cluster of the Scuppernong grape, but the largest number of berries yet found on a single cluster after a careful search of the best vines, was twenty-seven.

These figures strongly indicate self-sterility. Usually, most of the flowers fail to get pollinated with pollen from male vines.

The branch mentioned above which contained one hundred and twenty flower clusters, was typical of the remainder of the vine. This branch had a spread of two by two feet. The entire vine covered an arbor thirty-two by forty-four feet. If every flower on this

vine had developed into a normal sized berry it would have produced two hundred and nine bushels of fruit, or at the rate of six thousand four hundred and seventy-nine bushels per acre. The largest actual yield of this variety ever authentically reported was at the rate of eight hundred and seventy bushels per acre.

INFLUENCE OF MALE VINES.

The most prolific vines of the varieties studied have usually been found where there were male vines nearby. For example, the vines found within the city of Raleigh are not nearly so prolific as are those in the country or in the outskirts of the city. This is due to the very small number of male vines found in the city. The writers know of two Scuppernong vines in Raleigh, however, which are very prolific. In one instance a male vine is growing on the same arbor with the Scuppernong; in the other the male vine is less than one hundred feet from the Scuppernong vine.

Another good example is a vineyard of James just east of Raleigh. The most prolific vines are found in the two outer rows. There are two male vines on an arbor near one of these rows, and several male vines in the edge of the woods near the row on the other side.

FIG. 11.—Flower cluster of Scuppernong on right, male on left, in bloom.

A careful study was made of the influence that male vines have on the crop in a very large vineyard in the eastern part of the State. The Scuppernong and Mish vines immediately around the male vines

were far more prolific than similar vines some distance away, where other conditions were the same, such as age of vines and character of soil. A careful study showed that a Mish vine twenty-five feet from a male vine contained a little more than twice as much fruit as another Mish vine one hundred and fifty feet from this male vine.

In another portion of the vineyard a Mish vine twenty-five feet from another male vine contained three times as much fruit as another Mish vine one hundred and fifty feet away.

A Scuppernong vineyard in which there were male vines contained at least five times as much fruit per vine as another Scuppernong vineyard, on the same farm, in which there were no male vines.

Old neglected vines are sometimes more prolific than well cultivated vines. This is due to the presence of male vines which have come up under the arbor from the seeds of the Scuppernong.

APPARENT EXCEPTIONS.

The writer knows of Scuppernong vines which are long distances from male vines, in some instances as much as a fourth of a mile, which often bear good crops. Such vines indicate that the variety is self-fertile. Two such vines were used in this work, but these proved to be self-sterile just like all the other vines of this variety. A careful study of these vines showed that they produce good crops only when the weather during the blooming season is very favorable to insect work. When the weather is rainy and cloudy during the blooming season such vines produce very small crops.

Furthermore, since the blooming season of each variety covers two to four weeks, and since an enormous crop of flowers is usually produced, the chances are that insects will carry enough pollen long distances during favorable seasons to insure a fair crop of fruit.

AN EXCEPTIONAL VINE.

During the summer of 1910 an exceptional wild Muscadine vine was found about one mile from the Station grounds. It is a fruiting vine, with a very large number of pistils in each flower cluster, many clusters containing from one hundred to one hundred and fifty pistils. It is distinct from all other fruiting vines examined in that the stamens are like those on the male vines; that is, long, upright, with an abundance of good fertile pollen. Pollen from this vine placed in a sugar solution germinated readily, at least ninety-five per cent of the pollen grains in each cell germinating. While there are a great many pistils in each flower cluster, these pistils are very small in size, and the clusters of fruit are no larger than those on the self-sterile wild vines. This vine was found late in the season and our work with it has been too limited to draw any conclusions.

ABUNDANCE OF MALE VINES.

Wild Muscadine vines are very abundant all through the eastern half of this State. They are found in forests, along streams, roads, in hedge rows, in blackberry and plum thickets, and along neglected fences. At least seventy-five per cent of these are male vines. This explains why the cultivated Muscadines often bear abundantly, although male vines may never have been planted in the vineyard.

RESULTS.

The results obtained indicate conclusively that the leading varieties of cultivated Muscadine grapes are self-sterile. Also that practically all of the perfect flowered wild Muscadine grapes are self-sterile. While we have vines of all of T. V. Munson's hybrids of this species, only three of these have bloomed, and these have proved self-sterile. Munson states that the others also are self-sterile.

APPLICATION OF RESULTS

Since the cultivated varieties of this species are self-sterile, provision should be made for cross-pollinating them. Where such varieties are growing near wild male vines a fair crop may be obtained without planting any male vines. But to insure largest yields, male vines

FIG. 12.—Clusters showing pistils of Scuppernong on left: imperfect pistils of male on right.

should always be planted with these varieties. This is a rather expensive practice, as the male vines must be given space and cared for, although they do not bear any fruit themselves. The value of male vines in the vineyard will be most apparent during unfavorable

seasons. The question, whether cultivated varieties of other species can be used as pollinizers, will probably be asked. Up to the present time no varieties have been brought into cultivation that will serve this useful purpose. The blooming season of the Muscadine grapes is much later and lasts much longer than that of any self-fertile species.

It is impossible to state what proportion of a vineyard should be male vines. For best results it seems that a male vine should be planted for every fruiting vine and trained on the same arbor. This would certainly insure the largest crop. Such proximity of male vines would be especially serviceable during rainy weather when insects are not very active. The two vines would intermingle on the arbor, and the male flowers and fruiting flowers would be nearer each other than in any other method of planting.

But there are objections to this method of planting. Unless systematically pruned, the male vines will tend to make the arbor more dense and increase the amount of shade, both of which conditions are serious hindrances to the insects that carry the pollen. The double growth of vines would also increase the difficulties in pruning and in harvesting the fruit.

The most satisfactory plan probably would be to plant male vines in every third row, and to have only every third plant in this row a male vine. This would give one male plant for every eight fruiting plants, and these fruiting plants would be well grouped around the male vines. The following sketch, in which circles indicate fruiting vines and the crosses male vines, illustrates this method of planting:

O O O O O O

O X O O X O

O O O O O O

O O O O O O

O X O O X O

O O O O O O

KIND OF MALE VINES TO PLANT.

There is great variation in male vines. Some are very heavy bloomers, producing a great number of flower clusters of large size and hence an abundance of pollen, while other vines produce few flower clusters, often of small size, and hence comparatively little pollen. Some male vines bloom early, others late. Some have a long blooming season, while others bloom for only a short time. Fig. 13 shows the variation in the size of the flower clusters, and hence the amount of pollen produced.

FIG. 13.—Male flower clusters in bud. One on left showing size from an average vine; the one on right, size from an exceptional vine.

The cultivated varieties of Muscadine grapes also have a long blooming season; and some varieties bloom considerably earlier than others. This emphasizes the necessity of planting not simply male vines, but the right kind of male vines.

Varieties that bloom early, like the Hopkins, and Memory, should have early blooming male vines planted with them. Varieties that bloom during mid-season, like Scuppernong, James, Mish, Thomas, and Tenderpulp, should be planted with male vines blooming at that time. The late blooming varieties like Flowers, Flowers Improved, and Luola require late blooming male vines.

Nurserymen who sell varieties of this species should also propagate male vines which will correspond in blooming season with the particular varieties they are selling.

WEATHER DURING BLOOMING SEASON.

The entire blooming season of all varieties extends from the middle of May until the last of June. During that season the weather should be warm, with an abundance of sunshine and comparatively few showers. During such weather insects are most active, the pollen is in good condition, and fertilization takes place readily. The crop fails oftener from continued rains during the blooming season than from any other cause. Growers know that a wet June always means a poor crop of Muscadine grapes. Where male vines are abundant, wet weather during the blooming season is the only cause of a general crop failure among Muscadine grapes.

WORK OF INSECTS.

The pollen is carried from the male vines to the fruiting vines by insects, the most important of which are honey bees, and various flies. But these insects are not nearly so abundant nor so active on this species of grapes as they are on many other plants. This fact probably more than anything else accounts for the small proportion of flowers that develop into fruit. This probably explains why nature has provided such a large proportion of male vines. For this reason the writer recommends a larger proportion of male plants than is usually recommended for other self-sterile plants.

Every effort should be made to encourage bees. It is very evident from our results that at least one hive of bees should be kept where any large number of vines are grown.

SELF-STERILITY NOT ALWAYS RESPONSIBLE.

Self-sterility is not responsible for all poor crops. Even where male vines are abundant a vine may not produce a large crop. If the vines are very heavily fertilized with nitrogenous materials without a corresponding amount of potash and phosphoric acid, there will be a very rank growth of vines at the expense of fruit. Heavy clay soil is not suited to Muscadine grapes and the crop is usually light on such soils. Low, moist, black loam soil also produces a very rank growth and a small crop of fruit. Vines on very poor soil, unless liberally supplied with manure and commercial fertilizer, will usually give small crops of fruit. Where vines become badly affected with Black Rot the crop is materially reduced.

VALUE OF PRUNING.

One of the chief hindrances to proper cross-pollination is the very heavy growth of vines on many arbors, some of the old vines forming dense mats more than a foot thick. It is difficult for insects to get to many of the flower clusters in such compact growths, hence cross-

pollination is almost entirely prevented. This emphasizes the necessity of proper pruning and thinning of the vines so that insects can readily get to all the flowers. The vines should be systematically pruned every year during November. Such pruning seems to have a marked effect in increasing the size of the fruit clusters.

GROWING PLANTS FROM SEEDS.

One of the most interesting things that has developed in our work is the character of the seedlings grown from seeds of the Scuppernong. It is generally known that the seedlings of the Scuppernong in nearly every instance produce dark fruit, while the Scuppernong bears light-colored fruit. If the Scuppernong were self-fertile this probably would not happen. There are two types of male vines. On one, which resembles the Scuppernong, the leaves, young shoots, nodes, and tendrils are light or greenish in color. The other type, which resembles in vine characteristics the varieties bearing dark fruit, has dark leaves, and reddish tendrils, nodes, and shoots. In our first two years' work pollen from a "light" male vine only was used on the Scuppernong. The seeds were saved and planted. Every resulting seedling is "light" in color; and most of those having female flowers will produce light colored fruit.

The "light" male vines are very rare; we have found only six such vines after careful searching. The dark male vines are very abundant; and this explains why such a large proportion of the seedlings produce dark fruit where insects carry the pollen.

This fact will be of great value to grape breeders in the South, as the seedlings of the Scuppernong can be made to produce either dark or light colored fruit by selecting, in making the crosses, pollen from either the dark or light male vines.